ABSTRACT

Pyrolyzing gasification system and method of use including primary combustion of non-uniform solid fuels such as biomass and solid wastes within a refractory lined gasifier, secondary combustion of primary combustion gas within a staged, cyclonic, refractory lined oxidizer, and heat energy recovery from the oxidized flue gas within an indirect air-to-air all-ceramic heat exchanger or external combustion engine. Primary combustion occurs at low substoichoimetric air percentages of 10-30 percent and at temperatures below 1000 degrees F. Secondary combustion is staged and controlled for low NOx formation and prevention of formation of CO, hydrocarbons, and VOCs. The gasifier includes a furnace bed segmented into individual cells, each cell is independently monitored using a ramp temperature probe, and provided with controlled air injection. Gasifier air injection includes tuyere arrays, lances, or both. The oxidizer includes three serially aligned stages separated by air injecting baffles, and ability to adjust the exit air temperature.